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The evaluation of pneumoconiosis by risk factors gender and age groups in Turkiye, in 1990-2021: incidence, prevalence, deaths, and disability-adjusted life years

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ABSTRACT

Aims: The aim of this study was to evaluate the incidence and prevalence of pneumoconiosis, pneumoconiosis-related disability-adjusted life years (DALY) score, deaths and risk factors by gender and year in Turkiye.

Methods: In this study, the estimation data prepared by the Institute for health metrics and evaluation (IHME) for Turkiye in the global burden of disease study covering the years 1990-2021 were used. Descriptive statistics are given as mean and standard deviation. Comparisons according to gender were made with Independent Samples t test. The relationships between numerical variables were analyzed by pearson correlation coefficient (r).

Results: A total of 1755 pneumoconiosis-related deaths occurred in Turkiye between 1990 and 2021. Of the deaths, 687 (39%) were due to silicosis, 489 (28%) to coal worker pneumoconiosis, 451 (26%) to asbestosis and 128 (7%) to other pneumoconiosis. Of those who died, 1619 (92%) were men. The DALY score, incidence and prevalence are also higher in men. The most common risk factor affecting men is silica exposure, while for women it is asbestos exposure. After 2016, incidence and prevalence are decreasing.

Conclusion: Pneumoconiosis is more fatal in men and in the 65-80 age group. The effects of the disease vary across countries and even regions within the same country. It is important to take these differences into account in future research on pneumoconiosis. Regulation of working environments in sectors known to cause the disease will both ensure that people are less affected by an important occupational disease and prevent loss of workforce.

Keywords: Pneumoconiosis, asbestosis, silicosis, coal worker pneumoconiosis, risk factors

INTRODUCTION

Pneumoconiosis is the general name of fibrosis and other tissue reactions that develop due to the accumulation of substances such as dust, fibers or smoke in the lungs, which are often caused by exposure to industrial working environment.[1] It is one of the most common occupational diseases in the world and carries great social and economic burdens as specific treatment methods for pneumoconiosis are currently lacking.[2] The most common factors causing pneumoconiosis are asbestos fibers, crystalline silica and coal dust.[3] The three most common types of pneumoconiosis are asbestosis, silicosis and coal worker pneumoconiosis, although the first two are much more common.[4]

Silica exposure occurs in many workplaces such as mining and quarries, construction, glass, iron and steel, tire and plastic production, agricultural chemicals and automobile repair.[1,5,6] Asbestos exposure occurs frequently in workplaces such as asbestos cement production, ceiling covering, wall covering, fireproof fabric, brake and clutch linings, gasket making, ship building and repair.[1,5,6]

In addition to the duration and total amount of exposure to asbestos, silica, smoke, gas, etc. in these work environments, smoking, exposure to cigarette smoke, age and gender (more fatal in men) may increase the likelihood of developing the disease and the severity of the disease.[7,8] Factors such as regular ventilation in the workplace, taking the necessary precautions in the work environment and regular examinations are among the protective factors against pneumoconiosis.[6]

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The aim of this study was to evaluate the incidence and prevalence of pneumoconiosis, pneumoconiosis-related disability-adjusted life years (DALY) score, deaths and risk factors by gender and year in Turkiye. The aim of the study is to evaluate the changes in the factors associated with pneumoconiosis over the years. The secondary goal of the study is to evaluate the changes in the factors associated with pneumoconiosis over the years.

METHODS

In the global burden of disease study conducted by the IHME-(healthdata.org) to cover the years 1990-2021, estimation data prepared for Turkiye were used.[9] The acquisition and estimation of data within the scope of the global burden of disease study is carried out by IHME.[10] Since secondary data were utilized, the study did not require Ethics Committee approval. Within the scope of the study, the number of deaths due to pneumoconiosis, DALY (Disability-adjusted life year) score, incidence and prevalence were analyzed according to risk factors, gender and years. Risk factors were occupational exposure to asbestos, occupational exposure to silica, and occupational particulate matter, gases, and fumes (PMGF) as shared by IHME.

In this study, estimated data calculated in the Global Burden of Disease Study conducted by IHME were used. The limitation of the study is that analyses were based on estimated data rather than real data.

Statistical Analysis

Descriptive statistics are given as mean and standard deviation. Comparisons according to gender were made with independent samples t test. The relationships between numerical variables were analyzed with Pearson correlation coefficient (r). Excel (Microsoft 365 Apps for enterprise) and IBM SPSS Statistics 27.0.1.0 programs were used for statistical analysis, calculations, and graphic design.

RESULTS

In this study, the number of deaths due to pneumoconiosis, DALY scores and risk factors, and the incidence and prevalence of pneumoconiosis were evaluated by gender between 1990 and 2021 in Turkiye due to estimated data on IHME. In this study, the number of deaths due to pneumoconiosis, DALY scores and risk factors, and the incidence and prevalence of pneumoconiosis were evaluated by gender between 1990 and 2021.9 A total of 1755 pneumoconiosis-related deaths occurred in Turkiye between 1990 and 2021. Of the deaths, 687 (39%) were due to silicosis, 489 (28%) to coal worker pneumoconiosis, 451 (26%) to asbestosis and 128 (7%) to other pneumoconiosis. Of those who died, 1619 (92%) were men. In Figure 1 above, the total number of deaths, total DALYs, incidence and prevalence numbers due to pneumoconiosis are presented by sex and year. It is seen that each variable analyzed has increased over the years and is higher in men. Although the incidence and prevalence are higher in men, the values for both sexes are quite close to each other. Figure 2 above presents the total number of deaths, total DALYs, incidence and prevalence of pneumoconiosis by sex and age. The total number of deaths and total DALY scores are highest in men between 65 and 75 years of age, with a gradual decline at higher ages. Incidence is higher in women between 25-40 years of age and prevalence is higher in women between 35-45 years of age, and higher in men at other ages.

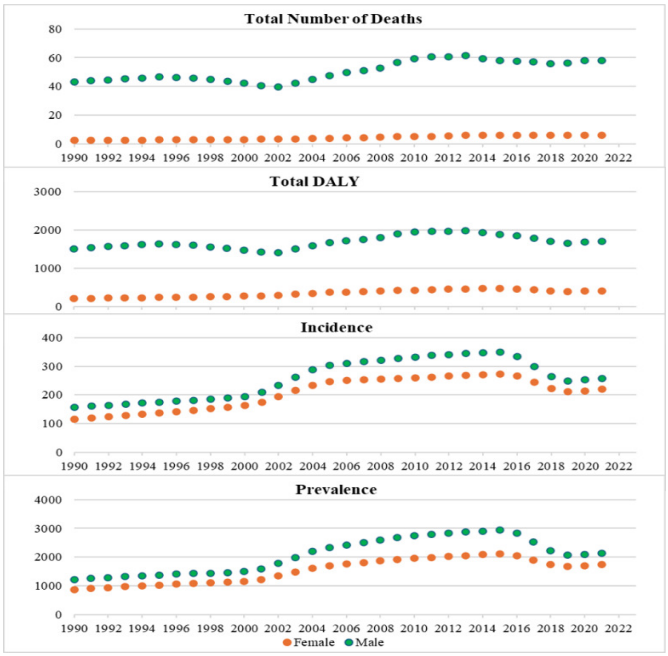

Figure 1. Number of Pneumoconiosis-related deaths, DALY, Incidence and Prevalance by gender and year.

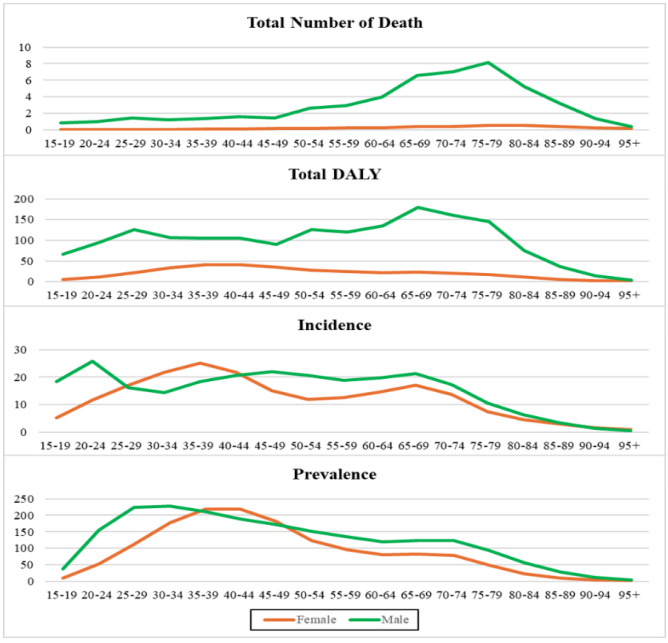

Figure 2. Number of Pneumoconiosis-related deaths, DALY, Incidence and Prevalance by gender and age group.

The difference between men and women shown in Figure 1 and Figure 2 was statistically analyzed for all age groups and all years (Table 1). It was observed that males had higher mean values in terms of number of deaths, DALYs, incidence and prevalence and this difference was found to be statistically significant ($p<0.001$). Table 2 below shows the percentage of deaths by risk factors by sex and age. Accordingly, for both men and in general, silica exposure (responsible for 40.3%-82.4% of deaths from pneumoconiosis) was found to be the risk factor causing the highest number of deaths for those aged 50 years and younger. In women, PMGF (36.8%-50.5%) was found in the 55-80 age range and asbestos exposure

was found to be the effective risk factor in other age groups, although this varied according to age. The difference between the percentages of silica, asbestos exposure and PMGF in men and women was analyzed by t-test and a significant difference was found (p<0.001).

Table1. Number of death, DALY, incidence, prevalence: by gender (all years, all ages).

	Female		Male		Female- Male
	Mean	SD	Mean	SD	
Death	4.270	1.413	50.589	7.093	t=36.226; p<0.001
DALY	342.509	90.098	1687.348	169.744	t=39.587; p<0.001
Incidence	205.494	55.126	256.428	69.103	t=-3.259; p=0.002
Prevelance	1531.090	425.577	2067.204	604.647	t=-4.102; p<0.001

Number: Number of deaths in the population, DALY: Disability-adjusted life years

Table 2. Percent of deaths caused by risk factors by gender (all years, all ages)

Age Group	Female			Male			Both		
	Asbest* (%)	Silica ** (%)	PMGF *** (%)	Asbest (%)	Silica (%)	PMGF (%)	Asbest (%)	Silica (%)	PMGF (%)
15-19	0.742	0.021	0.236	0.235	0.427	0.338	0.265	0.403	0.332
20-24	0.399	0.086	0.512	0.108	0.660	0.233	0.102	0.677	0.221
25-29	0.480	0.166	0.353	0.162	0.753	0.086	0.126	0.824	0.051
30-34	0.439	0.163	0.396	0.245	0.571	0.184	0.207	0.656	0.139
35-39	0.357	0.177	0.466	0.148	0.477	0.375	0.082	0.578	0.340
40-44	0.402	0.228	0.371	0.283	0.467	0.251	0.201	0.631	0.169
45-49	0.495	0.217	0.286	0.314	0.430	0.255	0.180	0.600	0.219
50-54	0.508	0.225	0.265	0.410	0.321	0.269	0.213	0.506	0.281
55-59	0.328	0.170	0.502	0.336	0.179	0.486	0.236	0.309	0.455
60-64	0.304	0.191	0.505	0.334	0.169	0.496	0.229	0.313	0.459
65-69	0.367	0.264	0.368	0.458	0.181	0.360	0.185	0.430	0.385
70-74	0.325	0.225	0.450	0.416	0.120	0.460	0.262	0.321	0.417
75-79	0.300	0.230	0.469	0.365	0.118	0.515	0.291	0.313	0.395
80-84	0.386	0.264	0.350	0.624	0.100	0.273	0.243	0.357	0.400
85-89	0.408	0.322	0.269	0.549	0.105	0.346	0.364	0.414	0.220
90-94	0.412	0.299	0.289	0.615	0.070	0.315	0.350	0.382	0.268
95+	0.448	0.212	0.338	0.600	0.065	0.332	0.378	0.283	0.338
All Ages	0.259	0.387	0.353	0.543	0.044	0.412	0.229	0.425	0.346

Percent: Proportion of deaths from a specific cause compared to deaths from all causes
*Occupational exposure to asbestos
**Occupational exposure to silica
***Occupational particulate matter, gases, and fumes

The number of deaths due to risk factors was analyzed and significant associations were found in all age groups (p<0.001). All associations were strong to very strong (Table 3).

Table 3. Relationships between the number of deaths caused by risk factors by gender (all years, all ages).

	Asbest*-Silica**		Asbest- PMGF***		Silica- PMGF	
	r	p	r	p	r	p
15-19	0.953	<0.001	0.959	<0.001	0.986	<0.001
20-24	0.924	<0.001	0.947	<0.001	0.987	<0.001
25-29	0.939	<0.001	0.910	<0.001	0.902	<0.001
30-34	0.946	<0.001	0.945	<0.001	0.951	<0.001
35-39	0.639	<0.001	0.683	<0.001	0.985	<0.001
40-44	0.936	<0.001	0.952	<0.001	0.961	<0.001
45-49	0.757	<0.001	0.833	<0.001	0.973	<0.001
50-54	0.898	<0.001	0.901	<0.001	0.990	<0.001
55-59	0.928	<0.001	0.965	<0.001	0.983	<0.001
60-64	0.916	<0.001	0.942	<0.001	0.987	<0.001
65-69	0.901	<0.001	0.944	<0.001	0.981	<0.001
70-74	0.943	<0.001	0.969	<0.001	0.985	<0.001
75-79	0.962	<0.001	0.986	<0.001	0.968	<0.001
80-84	0.908	<0.001	0.945	<0.001	0.983	<0.001
85-89	0.954	<0.001	0.960	<0.001	0.931	<0.001
90-94	0.929	<0.001	0.993	<0.001	0.937	<0.001
95+	0.796	<0.001	0.976	<0.001	0.883	<0.001
All Ages	0.886	<0.001	0.958	<0.001	0.970	<0.001

*Occupational exposure to asbestos
**Occupational exposure to silica
***Occupational particulate matter, gases, and fumes

Table 4 above shows the comparison of the number of deaths and mean DALY scores by gender for all age groups. The number of deaths and DALY scores due to risk factors were higher in men and this difference was statistically significant (p<0.001). The most significant difference occurred in silica for both number of deaths (t=58.509; p<0.001) and DALY score (t=60.187; p<0.001).

Table 4. Comparison of the number of deaths due to risk factors and mean DALY scores by gender (all years, all ages)

Mean		Female		Male		Female-Male
		SD	Mean	SD		
Death Number	Asbest*	2.353	0.766	11.726	3.230	t=15.975; p<0.001
	Silica**	0.145	0.050	21.304	2.045	t=58.509; p<0.001
	PMGF***	1.772	0.617	17.500	2.539	t=34.057; p<0.001
DALY Scores	Asbest	174.258	48.278	336.820	73.738	t=10.434; p<0.001
	Silica	24.555	4.653	828.904	75.456	t=60.187; p<0.001
	PMGF	143.645	38.016	520.128	58.072	t=30.683; p<0.001

*Occupational exposure to asbestos
**Occupational exposure to silica
***Occupational particulate matter, gases, and fumes
PMGF: Particulate matter, gases, and fumes

DISCUSSION

In a study conducted by Zhao et al.[11] in China, it was found that pneumoconiosis affects young adults aged 24-44 years and men more frequently and that the most common type is silicosis. In a study investigating silicosis cases in the UK, it was found that 93% of cases were caused by silica exposure, men were more affected and cases were most common among workers in metal manufacturing (21%) and quarries.[12] In this study, total deaths, total DALYs, incidence and prevalence were higher in men. However, both incidence and prevalence values are quite close to each other in men and women. In some age ranges, they are even higher in women. It is thought that this may be due to regional factors or the fact that women are more involved in working life in Turkiye (2014:30.3%; 2023:35.8%).[13] In addition, from 2014 to 2023, the number of women working in mining and quarrying, manufacturing, electricity, gas, steam, water supply and sewerage and construction sectors, which are known to directly affect pneumoconiosis, increases.[13]

In a study conducted in the USA, it was found that the highest prevalence of pneumonoconiosis was in the age group over 75 years and in men, approximately 70.0%-72.5% asbestosis was seen, and the prevalence increased by 3-10% annually between 2002-2009, and decreased significantly by 3%-5% between 2009-2019.[14] In this study, silica was found to be the most effective cause of death in men and asbestos and PMGF in women. The prevalence was found to be similar in men and women and was quite high in the age range of 20-50 years. Moreover, incidence and prevalence increased between 2000 and 2016 and decreased after 2016. It is thought that this may be due to changes in working environments.

A study conducted in Jiangsu, China found that between 1956 and 2021, the DALY score due to pneumoconiosis gradually decreased and the highest DALY score occurred due to silica.[15] Another study for China as a whole found that the DALY score increased by 20.8% between 1990 and 2019.[16] In this study, it was observed that the DALY score due to pneumoconiosis in Turkiye did not change significantly over the years and mostly affected the 65-80 age group.

The study's strength is that it examines the incidence, prevalence, death and DALY statistics due to pneumoconiosis between 1990 and 2021 by gender and age. It is thought that the study will make a significant contribution to the literature

by examining the disease burden over a long period. The use of estimated data published by IHME is a limitation of the study.

CONCLUSION

The increase in the prevalence of pneumoconiosis and the number of deaths in Turkiye over the years can be explained by the increase in the number of workers in sectors known to cause pneumoconiosis. While the number of deaths in men is significantly higher, the fact that there is no significant difference between the sexes in terms of prevalence and incidence can be considered as an indication that men experience the disease much more severely.

Studies show that the number of deaths, DALYs, incidence and prevalence of pneumoconiosis can vary significantly from country to country, even in different regions of the same country. Therefore, regional factors should be taken into account in interventions to prevent pneumoconiosis. In addition, gender differences should be investigated in more detail and policy recommendations should be developed. Regulation of working environments in sectors known to cause the disease will both ensure that people are less affected by an important occupational disease and prevent loss of workforce.

ETHICAL DECLARATIONS

Ethics Committee Approval

Since secondary data were utilized, the study did not require Ethics Committee approval.

Informed Consent

Because the study was designed retrospectively, no written informed consent form was obtained from patients.

Referee Evaluation Process

Externally peer-reviewed.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

Financial Disclosure

The authors declared that this study has received no financial support.

Author Contributions

All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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